Quantification and upscaling of greenhouse gas (GHG) fluxes from shallow waters, soils and trees in rural SE England

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Project background
The race toward net zero is hampered by poor understanding of many greenhouse gas sources and their emissions, and how to scale these up spatially and temporally. Uncertainties in global atmospheric carbon budgets arise mostly from natural sources (e.g. wetlands). Emissions are influenced by seasonal temperature and rainfall variability and anthropogenic changes in drainage, flooding and vegetation. Ratios of $^{13}\text{C}/^{12}\text{C}$ and $^{2}\text{H}/^{1}\text{H}$ help identify sources of CH$_4$ emissions and transport pathways from subsurface to atmosphere.

This studentship seeks to (i) quantify CH$_4$ and CO$_2$ fluxes from a range of landscapes and shallow water bodies, (ii) elucidate environmental factors that impact fluxes, (iii) characterise the isotopic composition of CH$_4$ emissions, and (iv), enhance the use of atmospheric measurements to verify UK GHG emissions inventories. Project outcomes will inform landscape/environmental management decisions that reduce emissions of greenhouse gases.

Research methodology
Field studies will be conducted at RBG Kew’s site at Wakehurst, the Straits Inclosure at Forest Research and at wetland regions across SE England. These will provide unique opportunities to quantify GHG fluxes and elucidate source-sink processes for different types of soils, trees and surface-waters. RHUL’s state-of-the-art vehicle-mounted and portable laser spectrometer systems, automated closed chambers and eddy covariance will measure CH$_4$ and CO$_2$ fluxes across different landscapes, with underlying drivers identified using RBG’s new wireless network of meteorological and soil sensors at Wakehurst.

Isotope ratio mass spectrometry will be used to measure $\delta^{13}\text{C}$ and $\delta\text{D}$ in samples for comparison with mobile data (see https://www.royalholloway.ac.uk/research-and-teaching/departments-and-schools/earth-sciences/research/research-laboratories/greenhouse-gas-laboratory/). Numerical and/or process-based models will utilise measured fluxes, climatic and soil data to extrapolate to regional landscapes, and make predictions for future emission scenarios and their likely role in climate change.

Training
Training will be provided in project planning, field sampling, greenhouse gas and stable isotope analysis, data interpretation, statistical and spatial analysis and modelling. The student will attend synergistic project meetings, help formulate research strategies, present / publish their findings, and undertake a 3-month secondment to Forest Research.

Person specification
Applicants should have an appropriate highly numerate science degree, including environmental science, geoscience, biology, chemistry, physics, and ideally should have field and laboratory experience.
Key references


France, J.L., Fisher, R.E., Lowry, D. & 21 others (in press), $\delta^{13}$C methane source signatures from tropical wetland and rice field emissions, Phil Trans R. Soc. A.


Application details

This project has been shortlisted for funding by the ARIES NERC DTP and will start on 1st October 2022. The closing date for applications is 23:59 on 12th January 2022.

Successful candidates who meet UKRI’s eligibility criteria will be awarded a NERC studentship, which covers fees, stipend (£15,609 p.a. for 2021-22) and research funding.

International applicants (EU and non-EU) are eligible for fully-funded UKRI studentships.

Please note ARIES funding does not cover visa costs (including immigration health surcharge) or other additional costs associated with relocation to the UK. ARIES students benefit from bespoke graduate training and ARIES provides £2,500 to every student for access to external training, travel and conferences. Excellent applicants from quantitative disciplines with limited experience in environmental sciences may be considered for an additional 3-month stipend to take advanced-level courses in the subject area.

ARIES is committed to equality, diversity, widening participation and inclusion in all areas of its operation. We encourage enquiries and applications from all sections of the community regardless of gender, ethnicity, disability, age, sexual orientation and transgender status. Academic qualifications are considered alongside non-academic experience, and our recruitment process considers potential with the same weighting as past experience.

Applications should be made via the Royal Holloway Direct website

Please contact d.lowry@rhul.ac.uk for further information.